UM0919
User Manual

STM32VLDISCOVERY
STM32 Value line Discovery

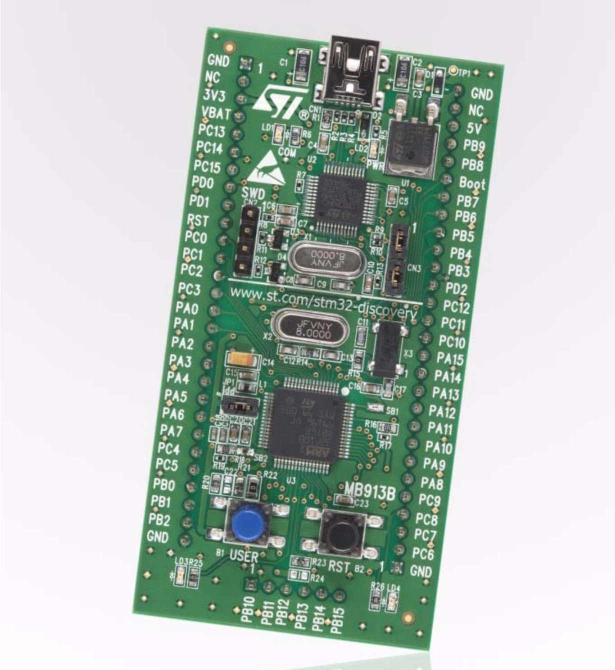
Introduction

The STM32 Value line Discovery evaluation board helps you discover the STM32 Value line features and to develop and share your applications. It is based on an STM32F100RBT6B and includes ST-Link embedded debug tool interface, LEDs and push buttons.

Features

- STM32F100RBT6B microcontroller, 128 KB Flash, 8 KB RAM
- Powered by USB cable between PC and STM32 Value line Discovery
- Embedded debugger ST-Link, SWD debug support
- USB interface for programming and debugging
- Red LED for USB communication, red LED for 3.3 volts power on
- Can be externally powered by 5 volts or 3 volts
- Can power supply external application with 5 volts and 3 volts
- Two user LED, LD3 and LD4 (green and blue)
- Two push buttons (User and Reset)
- Extension header for all I/Os

Figure 1. STM32 Value line Discovery board



Contents

1 Quick start 3

1.1 Getting started 3

1.2 System requirements 3

1.3 Development toolchain 3

1.4 Demonstration software 3

1.5 Order code 3

2 Hardware and layout 4

2.1 STM32F100RBT6B microcontroller 7

2.2 Embedded ST-Link 9

2.2.1 Using the STM32 Value line Discovery as an ST-Link 10

2.2.2 Re-using the board as an STM32 Value line Discovery 11

2.3 Power supply and power selection 11

2.4 LEDs 12

2.5 Push buttons 12

2.6 JP1 (Idd) 12

2.7 Solder bridges 13

3 Extension connection 14

4 Electrical schematics 18

5 Revision history 22

1 Quick start

This product evaluates the STM32 microcontroller.

Before installing and using the product, please accept the Evaluation Product License Agreement from www.st.com/stm32-discovery.

For more information on the STM32 Value line Discovery and for demonstration software visit www.st.com/stm32-discovery.

1.1 Getting started

1. Connect the STM32 Value line Discovery board to a PC with a USB cable to power the board.
2. Press the USER button B1 (on bottom left corner of the board).
3. Observe how the green LED LD3 blinking changes according to USER button B1 clicks.
4. Each click on USER button B1 is confirmed by the blue LED LD4.
5. To study or modify the DISCOVER project related to this simple demo, visit www.st.com/stm32-discovery and follow the tutorial.
6. Discover the STM32 features, download and execute programs proposed in the list of projects.
7. Develop your own application using available examples.

1.2 System requirements

- Windows PC (2000, XP, Vista)
- A/Mini-B USB cable

1.3 Development toolchain

- Atollic, TrueSTUDIO®
- IAR, Embedded Workbench® for ARM
- Keil, MDK-ARM™

1.4 Demonstration software

Demonstration software is preloaded in the board's Flash memory for easy demonstration of the device peripherals in stand-alone mode. For more information and to download the latest version available, please refer to the STM32 Value line Discovery demonstration software available on www.st.com.

1.5 Order code

To order the STM32 Value line Discovery, use the order code STM32VLDISCOVERY.

2 Hardware and layout

The STM32 Value line Discovery is designed around the STM32F100RBT6B microcontroller in a 64-pin LQFP package.

Figure 2 illustrates the connections between the STM32F100RBT6B and its peripherals (ST-Link, push button, LED and connectors).

Figure 3 and *Figure 4* help you to locate these features on the STM32 Value line Discovery.

Figure 2. Hardware block diagram

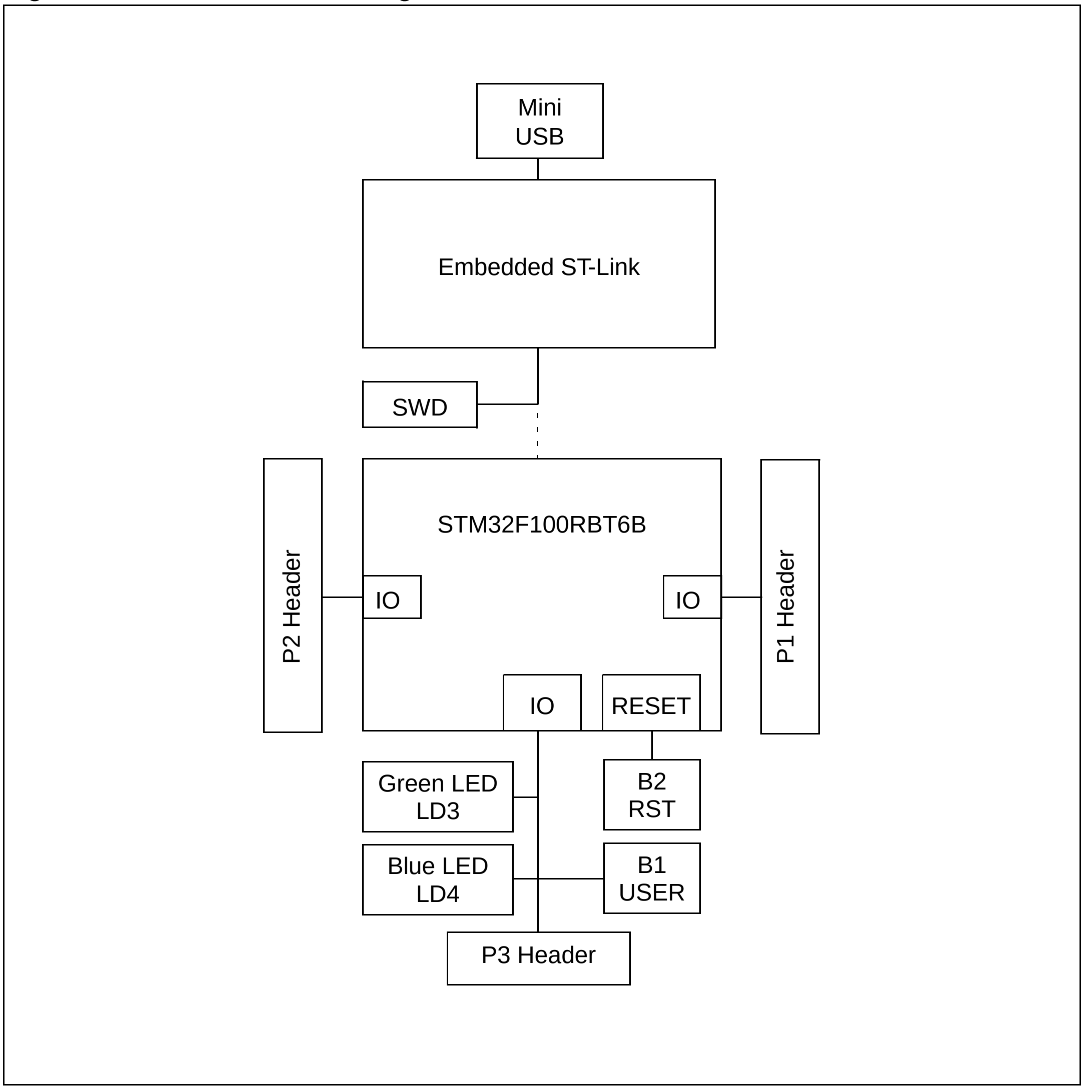


Figure 3. Top layout

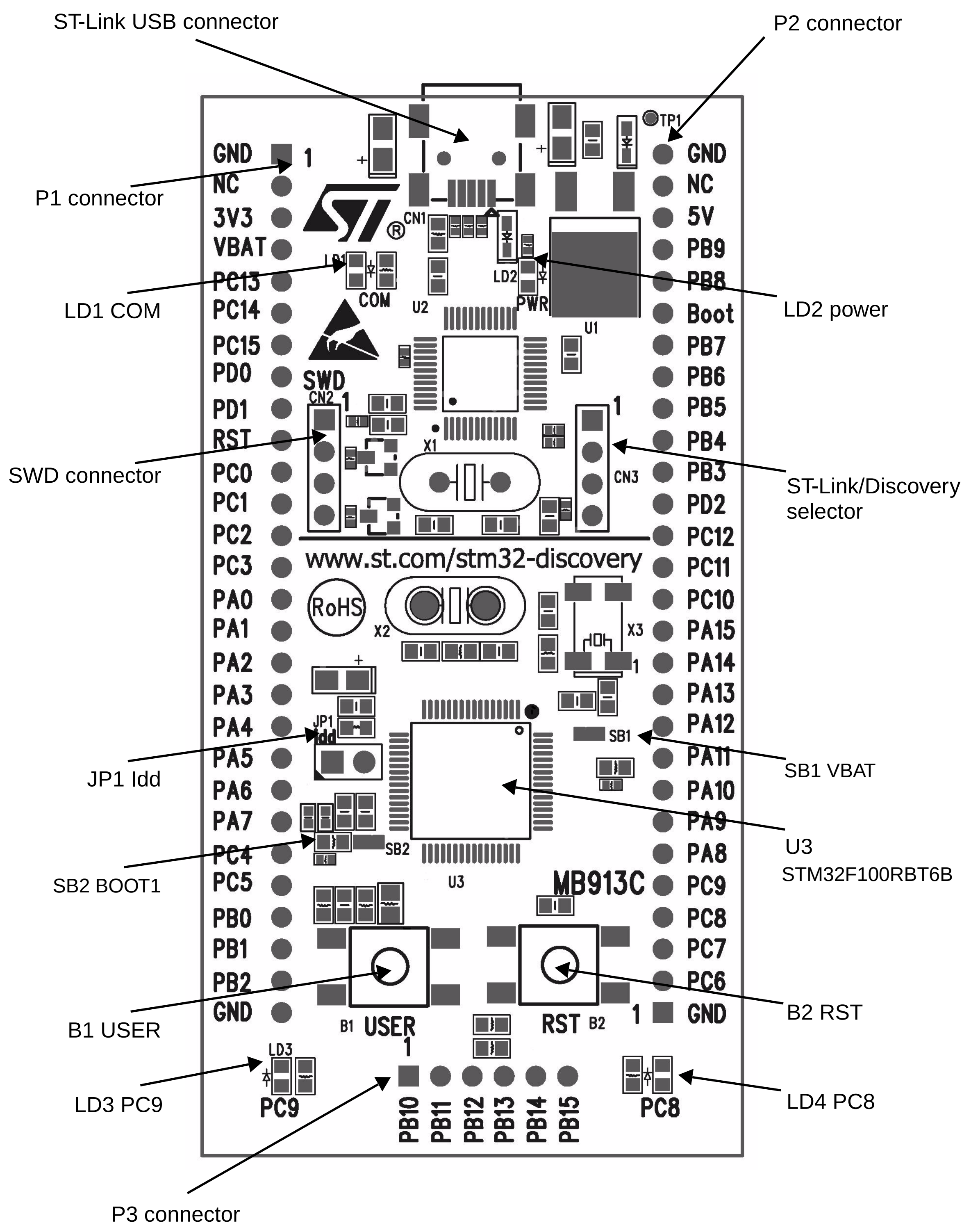
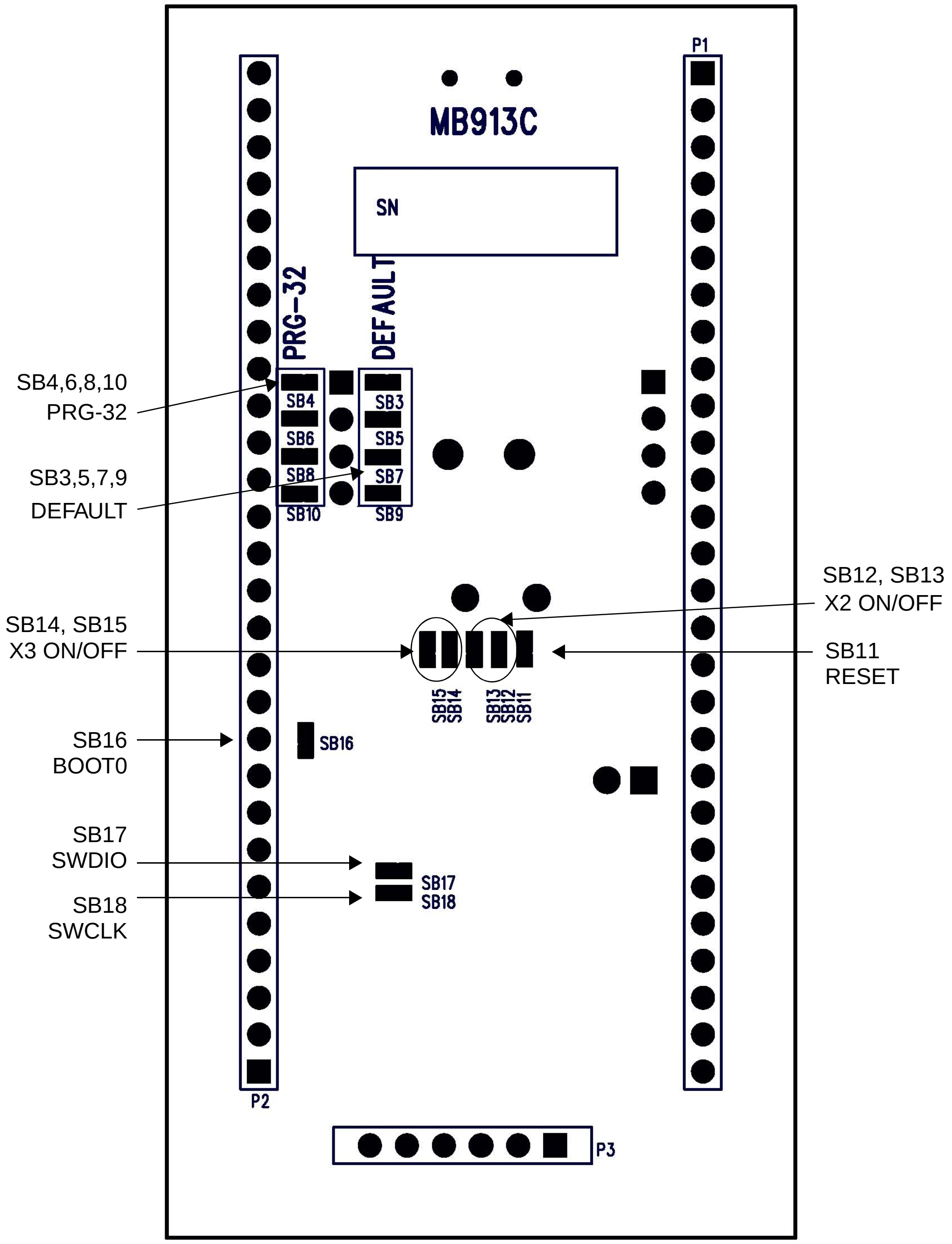
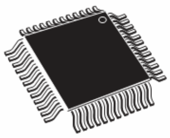


Figure 4. Bottom layout



2.1 STM32F100RBT6B microcontroller

Figure 5. STM32F100RBT6B package



LQFP64 10 x 10 mm

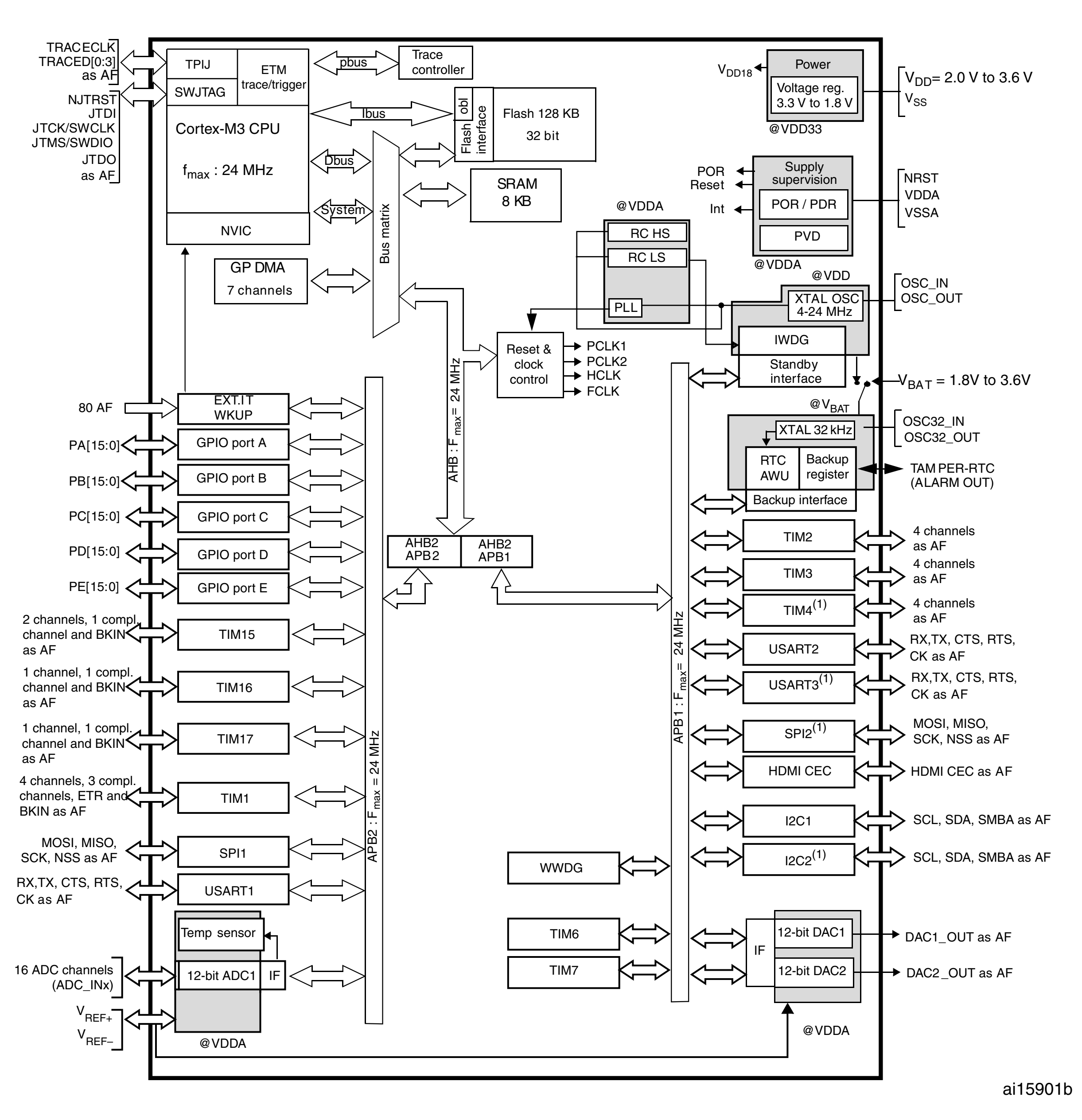
The STM32F100RBT6B 8-bit microcontroller offers:
- 128 Kbytes of Flash memory
- 8 Kbytes RAM

This device provides the following benefits:

- Reduced system cost:
  - Built-in POR, PDR, LVD, watchdog timer.
  - Factory trimmed 8 MHz RC oscillator and 40 kHz for RTC and watchdog.
  - On-chip 12-bit dual channel DAC with DMA support and output buffers.
- Perfect fit for control applications: Up to seven PWM 16-bit timers including advanced control timer for a total of 26 channels.
- Ideal for appliance control applications including induction cooking: Three independent PWM 16-bit timers with complementary output and dead-time generation.
- Reduced design complexity and minimized CPU, peripheral and memory use: Consumer electronics control (CEC) peripheral.
- Extensive connectivity capability: CEC, 400 kHz I²C, up to12 Mbit/s master and slave SPI, up to 3 Mbit/s USART.
- Achieves superior performance with 16-bit code density: ARM Cortex-M3 Thumb-2 32-bit instruction set and 7-channel DMA.
- Eases Flash memory integrity check: CRC (cyclic redundancy check) with DMA support.

For more information see the STM32F100xB datasheet (Doc ID 16455) on the ST website.

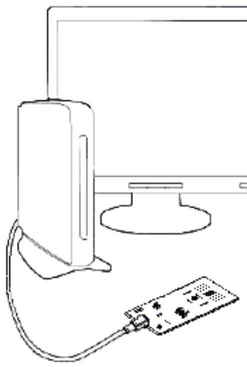
Figure 6. STM32F100RBT6B block diagram



2.2 Embedded ST-Link

The ST-Link programming and debugging tool is integrated on the STM32 Value line Discovery. It is possible to use the STM32 Value line Discovery as an ST-Link.

Figure 7. Typical configuration

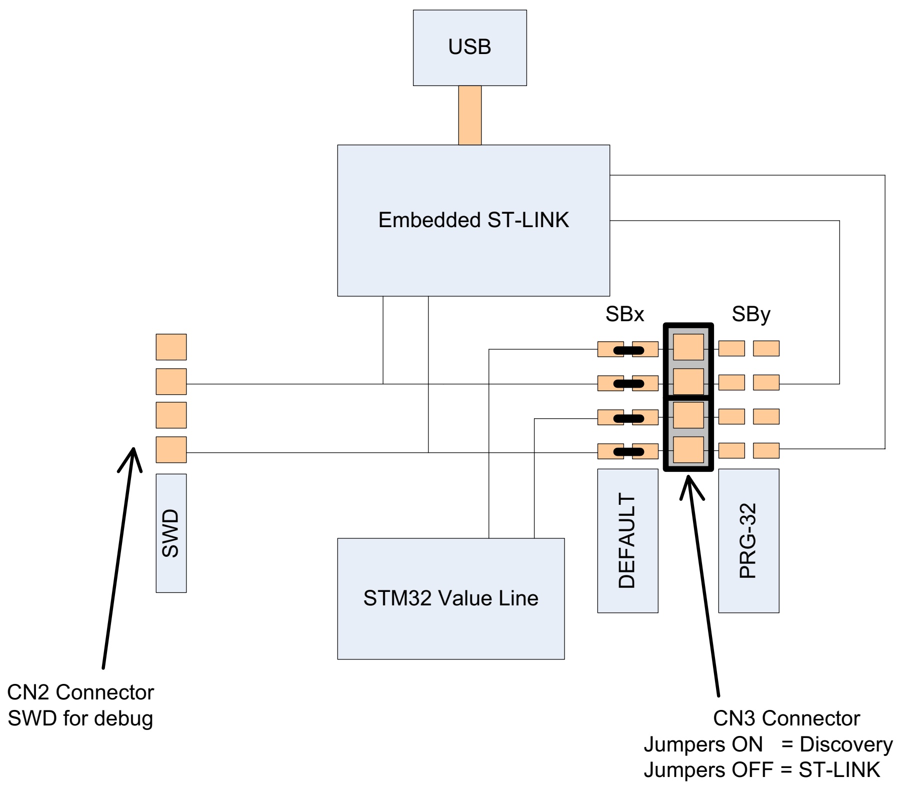


Hardware requirements:
- USB cable type A to mini-B
- Computer with Windows 2000, XP or Vista OS

Development toolchain:
- Atollic, TrueSTUDIO®
- IAR, Embedded Workbench® for ARM
- Keil, MDK-ARMTM

For information about debugging and programming features refer to ST-Link UM0627, UM0036 STVD and RN0011 STVP.

Figure 8. ST-Link connections block diagram



2.2.1 Using the STM32 Value line Discovery as an ST-Link

It is very easy to use the STM32 Value line Discovery as an ST-Link. You simply remove the 2 jumpers from CN3 and connect your application to the CN2 debug connector (as shown in *Figure 9* and according to *Table 1*.).

Note: Only SWD is supported, not JTAG.

Table 1. Debug connector CN2 (SWD)

Pin	CN2	Designation
1	VDD_TARGET	VDD from application
2	SWCLK	SWD clock
3	GND	Ground
4	SWDIO	SWD data input/output

Figure 9. ST-Link connections image

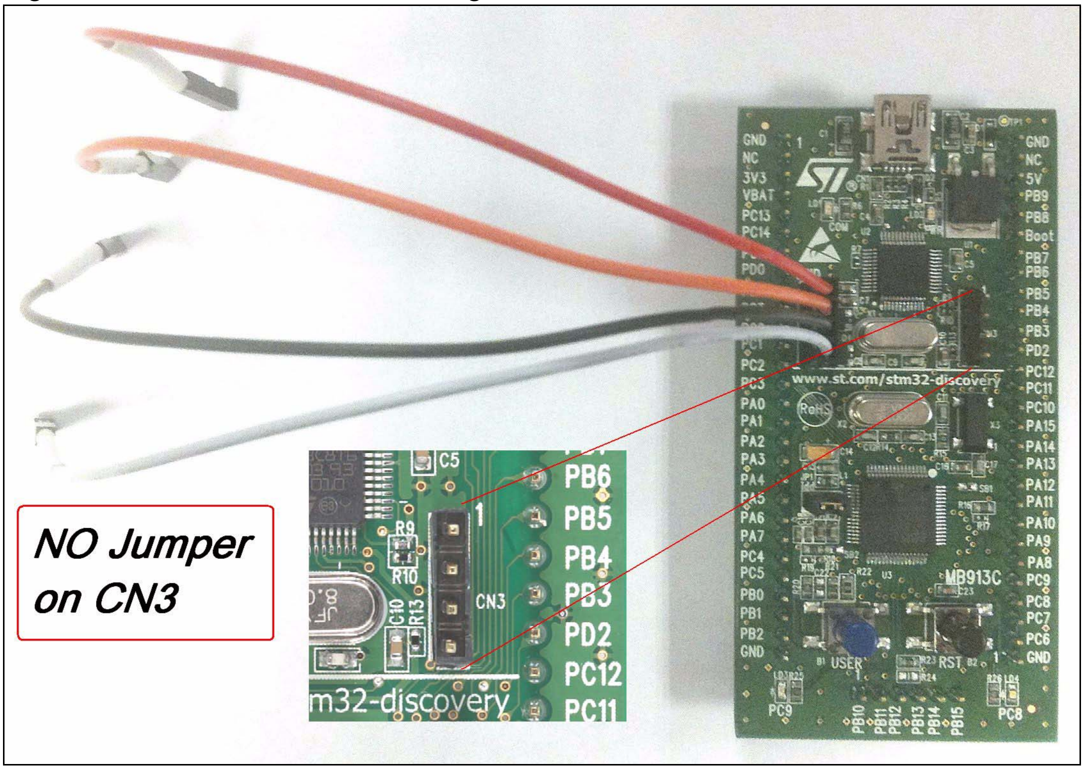


Table 2. summarizes the jumper settings required for the various uses.

Table 2. Jumper states

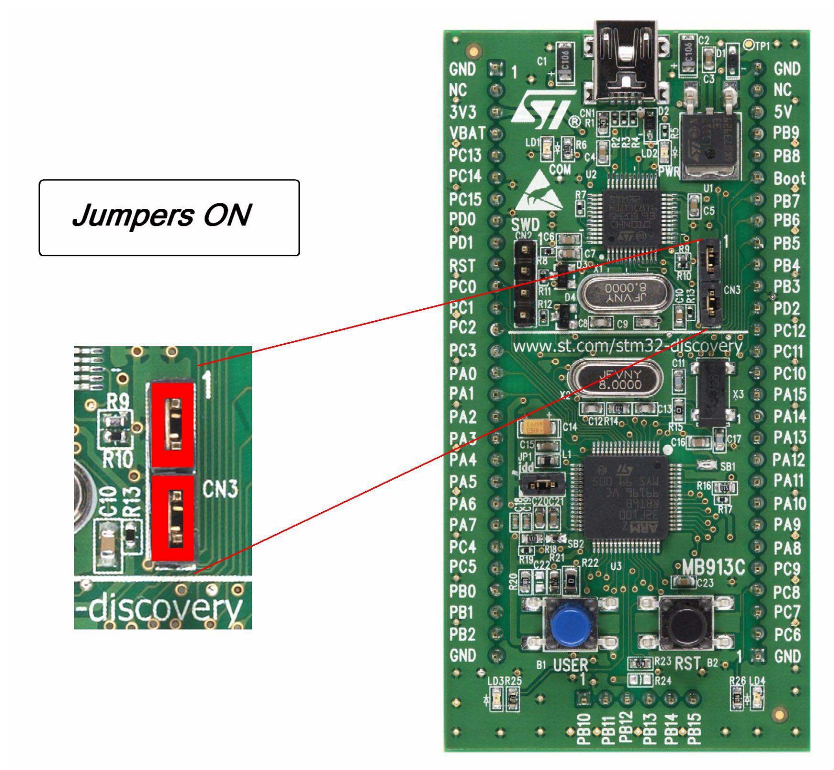
Jumper state	Description
SB3,5,7,9 ON, SB4,6,8,10 OFF, Jumpers ON	Default, Discovery functions enabled
SB3,5,7,9 ON, SB4,6,8,10 OFF, Jumpers OFF	Debug, ST-Link functions enabled for external application through CN2 connector. (SWD Supported)
SB3,5,7,9 OFF, SB4,6,8,10 ON, Jumpers OFF	PRG-32, Program STM32 dedicated to ST-Link through CN3

Caution: Other positions are reserved and could damage the board.

2.2.2 Re-using the board as an STM32 Value line Discovery

To reuse this board as an STM32 Value line Discovery, simply plug in the two jumpers on CN3 as before, but do not use the CN2 connector as that could disturb communication with the STM32F100RBT6B of the STM32 Value line Discovery.

Figure 10. Discovery connections image



2.3 Power supply and power selection

The power supply is provided by a USB connector or external power supply (5V or 3.3V). The 5V and 3V3 pins can be used independently as input or output power supplies due to D1 and D2 protection diodes (see *Figure 3*).

2.4 LEDs

- LD1: Red LED LD1 labeled COM indicates communication between PC and ST-Link.
- LD2: Red LED LD2 labeled PWR indicates that the board is powered.
- LD3: Green LED LD3 labeled PC9 is connected to the I/O PC9 of STM32F100RBT6B.
- LD4: Blue LED LD4 labeled PC8 is connected to the I/O PC8 of STM32F100RBT6B.

2.5 Push buttons

- B1: Push button B1 labeled USER is connected to the I/O PA0 of STM32F100RBT6B and can be used as WAKE-UP.
- B2: Push button B2 labeled RST is dedicated to RESET pin of STM32F100RBT6B.

2.6 JP1 (Idd)

Jumper JP1 labeled Idd allows the consumption of STM32F100RBT6B to be measured by removing the jumper and connecting an ammeter.

- Jumper on: STM32F100RBT6B is powered (default).
- Jumper off: STM32F100RBT6B is not powered.

2.7 Solder bridges

Table 3. Solder bridge description

Bridge	State[1]	Description
SB1 (VBAT)	**Off**	By default, VDD_MCU is not connected to VBAT of STM32F100RBT6B. VBAT could be connected to an external power supply through EXT_VBAT.
	On	VBAT of STM32F100RBT6B is powered by VDD_MCU.
SB2 (BOOT1)	Off	BOOT1 (PB2) signal is connected to +3.3V through pull-up resistor.
	On	By default, BOOT1 (PB2) signal is connected to GND through pull-down resistor.
SB3,5,7,9 (DEFAULT)	Off	Discovery ST-Link function is disabled.
	On	By default, the Discovery ST-Link function is enabled.
SB4,6,8,10 (PRG-32)	**Off**	By default, disable SWD of STM32 dedicated to embedded ST-Link.
	On	SWD of STM32 dedicated to embedded ST-Link for programming
SB11 (RESET)	Off	RESET of STM32F100RBT6B is disconnected from T_JRST of ST-Link.
	On	By default, RESET of STM32F100RBT6B is connected to T_JRST of ST-Link.
SB12 (X2)	**Off**	By default, PD1 is not connected to external pin and the X2 can be used. [2]
	On	PD1 is connected to external pin and can be used as GPIO, X2 is not available. Remove R15
SB13 (X2)	**Off**	By default, PD0 is not connected to external pin and the X2 can be used.[2]
	On	PD0 is connected to external pin and can be used as GPIO, X2 is not available. Remove R15.
SB14 (X3)	**Off**	By default, PC15 is not connected to external pin and the X3 can be used.[2]
	On	PC15 is connected to external pin and can be used as GPIO, X3 is not available. Remove R14.
SB15 (X3)	**Off**	By default, PC14 is not connected to external pin and the X3 can be used.[2]
	On	PC14 is connected to external pin and can be used as GPIO, X3 is not available. Remove R14.
SB16 (BOOT0)	Off	BOOT0 signal is connected to +3.3V through pull-up resistor.
	On	By default, BOOT0 signal is connected to GND through pull-down resistor.
SB17 (SWDIO)	Off	SWDIO and PA13 of STM32F100RBT6B are not connected, SWD not available.
	On	By default, SWDIO and PA13 of STM32F100RBT6B are connected, SWD available.
SB18 (SWCLK)	Off	SWCLK and PA14 of STM32F100RBT6B are not connected, SWD not available
	On	By default, SWCLK and PA14 of STM32F100RBT6B are connected, SWD not available.

1. Default state is in **bold** type.
2. If the resistor has been removed, it must be replaced.

3 Extension connection

Male headers P1, P2 and P3 can connect the STM32 Value line Discovery to a standard prototyping/wrapping board. All GPI/Os of STM32F100RBT6B are available on it.
P1, P2 and P3 can also be used to probe an oscilloscope, logical analyzer or voltmeter (measuring instrument).

Table 4. P1 pinout

Pin number (P1)	Pin number (chip)	Board pin name	Type	Main function	Alternate function	Remap
1	12/31/47/63	GND	-	Vss		
2	-	NC	-	-		
3		3V3	-	-		
4	1	VBAT	S	VBAT		
5	2	PC13	I/O	Port C13	TAMPER-RTC	
6	3	PC14(1)	I/O	Port C14	OSC32_IN	
7	4	PC15(1)	I/O	Port C15	OSC32_OUT	
8	5	PD0(1)	I/O	OSC_IN		
9	6	PD1(1)	I/O	OSC_OUT		
10	7	NRST	I/O	RESET		
11	8	PC0	I/O	Port C0	ADC1_IN10	
12	9	PC1	I/O	Port C1	ADC1_IN11	
13	10	PC2	I/O	Port C2	ADC1_IN12	
14	11	PC3	I/O	Port C3	ADC1_IN13	
15	14	PA0	I/O	Port A0	WKUP / USART2_CTS/ ADC1_IN0 / TIM2_CH1_ETR	
16	15	PA1	I/O	Port A1	USART2_RTS/ ADC1_IN1 / TIM2_CH2	
17	16	PA2	I/O	Port A2	USART2_TX/ ADC1_IN2 / TIM2_CH3/ TIM15_CH1	
18	17	PA3	I/O	Port A3	USART2_RX/ ADC1_IN3 / TIM2_CH4 / TIM15_CH2	
19	20	PA4	I/O	Port A4	SPI1_NSS/ ADC1_IN4 USART2_CK / DAC1_OUT	

Table 4. P1 pinout (continued)

Pin number (P1)	Pin number (chip)	Board pin name	Type	Main function	Alternate function	Remap
20	21	PA5	I/O	Port A5	SPI1_SCK/ ADC1_IN5 / DAC2_OUT	
21	22	PA6	I/O	Port A6	SPI1_MISO/ ADC1_IN6 / TIM3_CH1	TIM1_BKIN / TIM16_CH1
22	23	PA7	I/O	Port A7	SPI1_MOSI/ ADC1_IN7 / TIM3_CH2	TIM1_CH1N / TIM17_CH1
23	24	PC4	I/O	Port C4	ADC1_IN14	
24	25	PC5	I/O	Port C5	ADC1_IN15	
25	26	PB0	I/O	Port B0	ADC1_IN8/ TIM3_CH3	TIM1_CH2N
26	27	PB1	I/O	Port B1	ADC1_IN9/ TIM3_CH4	TIM1_CH3N
27	28	PB2	I/O	Port B2/ BOOT1		
28		GND				

1. Alternate pin, connected by default to STM32F100RBT6B oscillator.

Table 5. P2 pinout

Pin number (P2)	Pin number (chip)	Pin name	Type	Main function	Alternate function	Remap
1	29	PB10	I/O	Port B10	I2C2_SCL/ USART3_TX TIM2_CH3/ CEC	
2	30	PB11	I/O	Port B11	I2C2_SDA/ USART3_RX	TIM2_CH4
3	33	PB12	I/O	Port B12	SPI2_NSS/ I2C2_SMBA/ TIM1_BKIN/ USART3_CK	
4	34	PB13	I/O	Port B13	SPI2_SCK / TIM1_CH1N USART3_CTS	
5	35	PB14	I/O	Port B14	SPI2_MISO/ TIM1_CH2N / USART3_RTS	TIM15_CH1
6	36	PB15	I/O	Port B15	SPI2_MOSI / TIM1_CH3N / TIM15_CH1N	TIM15_CH2

Table 6. P3 pinout

Pin number (P3)	Pin number (chip)	Pin name	Type	Main function	Alternate function	Remap
1		GND				
2		NC				
3	38	PC7	I/O	Port C7		TIM3_CH2
4	39	PC8	I/O	Port C8		TIM3_CH3
5	40	PC9	I/O	Port C9		TIM3_CH4
6	41	PA8	I/O	Port A8	USART1_CK / MCO TIM1_CH1	
7	42	PA9	I/O	Port A9	USART1_TX / TIM1_CH2	TIM15_BKIN
8	43	PA10	I/O	Port A10	USART1_RX / TIM1_CH3	TIM17_BKIN
9	44	PA11	I/O	Port A11	USART1_CTS / TIM1_CH4	
10	45	PA12	I/O	Port A12	USART1_RTS / TIM1_ETR	
11	46	PA13	I/O	JTMS/ SWDIO		PA13
12	49	PA14	I/O	JTCK/ SWCLK		PA14
13	50	PA15	I/O	JTDI		TIM2_CH1_ETR / PA15/ SPI1_NSS
14	51	PC10	I/O	Port C10		USART3_TX
15	52	PC11	I/O	Port C11		USART3_RX
16	53	PC12	I/O	Port C12		USART3_CX
17	54	PD2	I/O	Port D2	TIM3_ETR	
18	55	PB3	I/O	JTDO		TIM2_CH2 / PB3 TRACESWO SPI1_SCK
19	56	PB4	I/O	NJTRST		PB4 / TIM3_CH1 SPI1_MISO
20	57	PB5	I/O	Port B5	I2C1_SMBA / TIM16_BKIN	TIM3_CH2 / SPI1_MOSI
21	58	PB6	I/O	Port B6	I2C1_SCL/ TIM4_CH1 TIM16_CH1N	USART1_TX
22	59	PB7	I/O	Port B7	I2C1_SDA/ TIM17_CH1N TIM4_CH2	USART1_RX

Table 6. P3 pinout (continued)

Pin number (P3)	Pin number (chip)	Pin name	Type	Main function	Alternate function	Remap
23	60	BOOT0	I	BOOT0		
24	61	PB8	I/O	Port B8	TIM4_CH3 / TIM16_CH1 / CEC	I2C1_SCL
25	62	PB9	I/O	Port B9	TIM4_CH4 / TIM17_CH1	I2C1_SDA
26		EXT_5V				
27		NC				
28		GND				

4 Electrical schematics

Figure 11. STM32 Value line Discovery

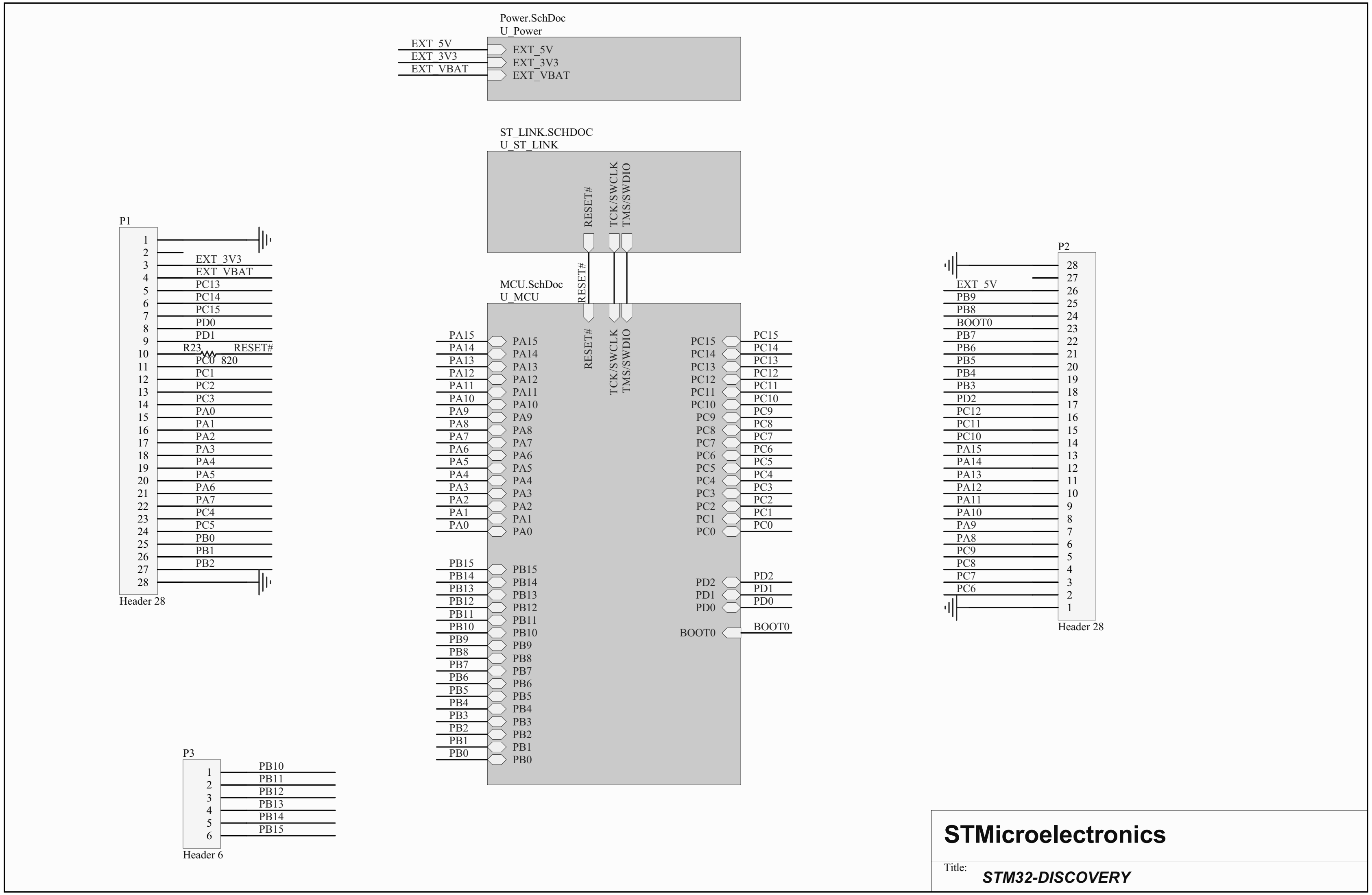


Figure 12. STM32 value line MCU

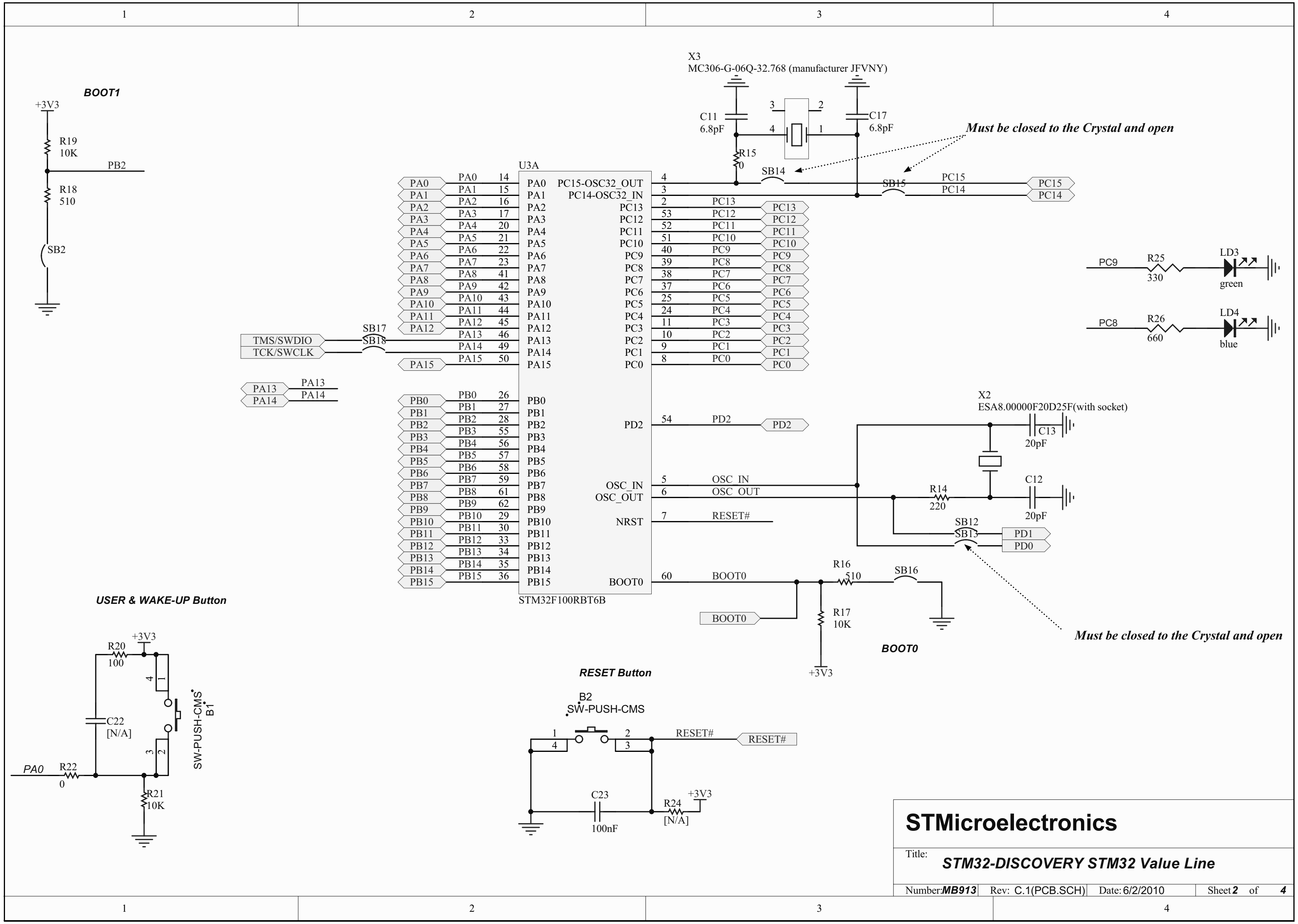


Figure 13. Power 5V and 3V3

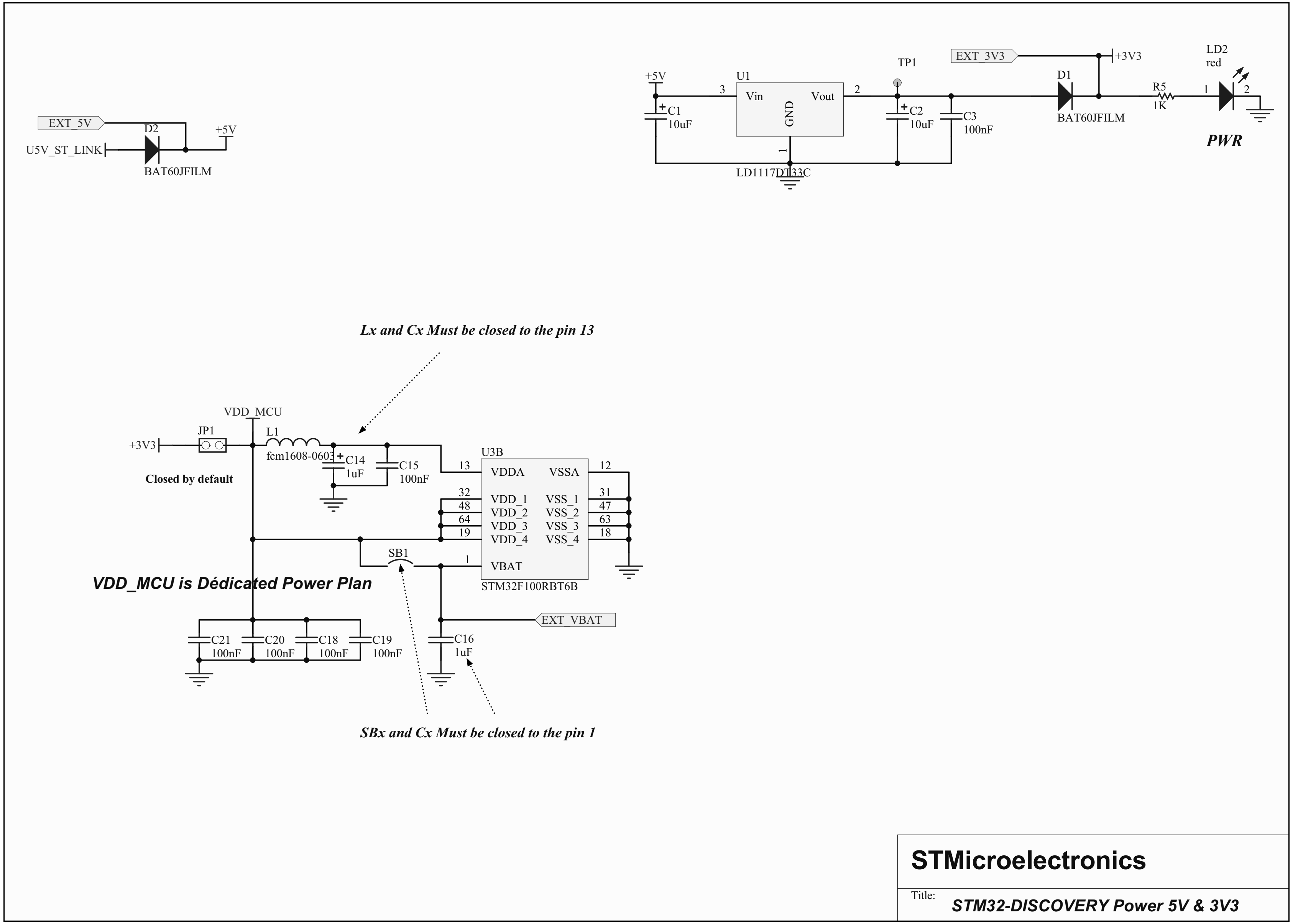
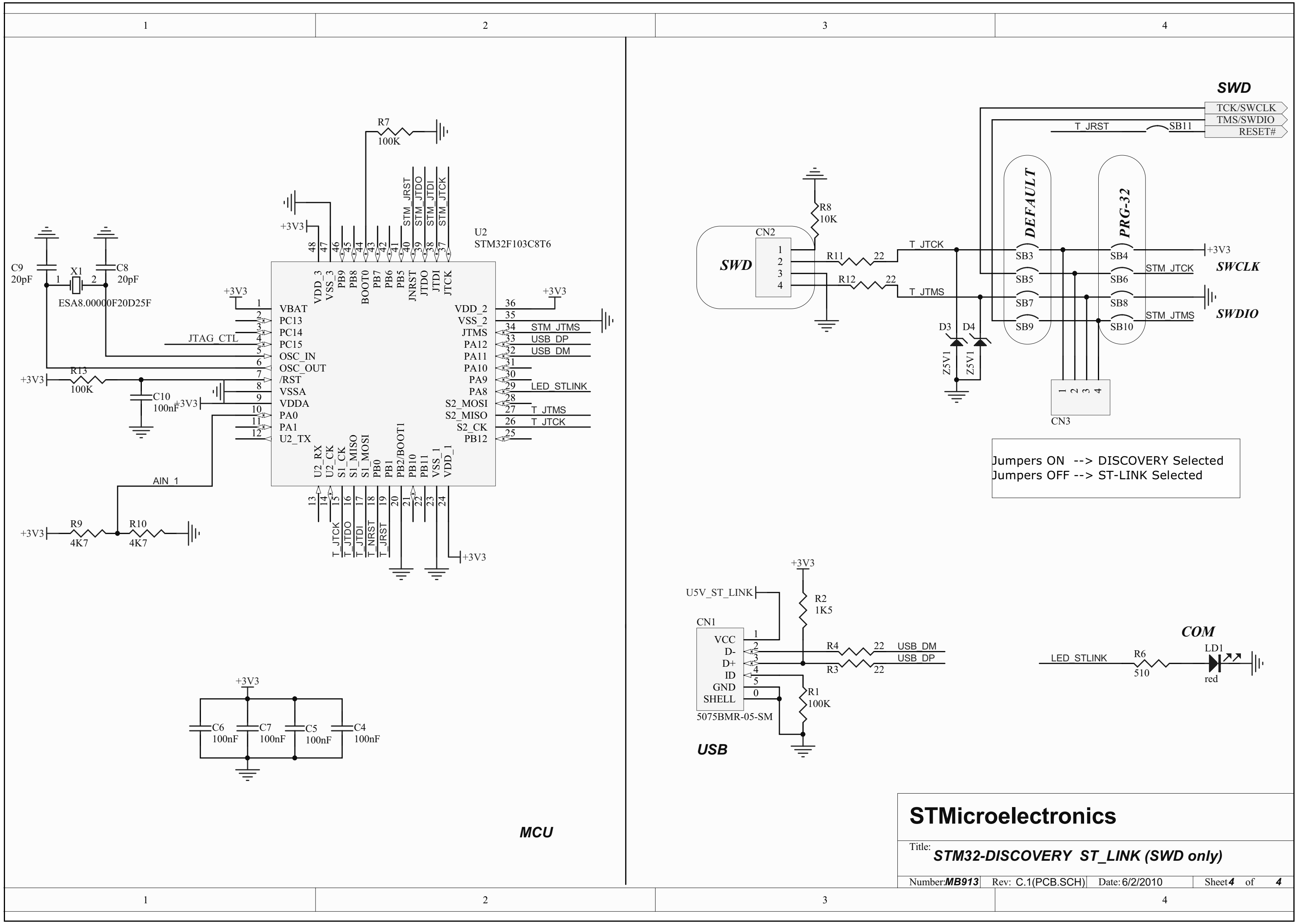


Figure 14. ST-Link (SWD only)



5 Revision history

Table 7. Document revision history

Date	Revision	Changes
25-Jun-2010	1	Initial release.